Small Mammals in Openings in Virginia's Dismal Swamp

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ABSTRACT.— In a study of small mammals of openings in the Dismal Swamp of Virginia, seven species were obtained using pitfall traps. Samples included several species rarely caught in the Swamp —seven specimens of the Dismal Swamp subspecies of the southern bog lemming, *Synaptomys cooperi helaletes*, the first collected in this century; two least shrews, *Cryptotis parva*; and 15 southeastern shrews, *Sorex longirostris fisheri*. Results are compared to previous studies, conducted primarily in forested habitats, in which the white-footed mouse, *Peromyscus leucopus*, and the golden mouse, *Ochrotomys nuttalli*, were numerically dominant.

INTRODUCTION

The Great Dismal Swamp, originally occupying much of the area between Virginia's James River drainage system and North Carolina's Albemarle Sound, has long been recognized as a vegetationally distinctive region with many unusual features. It has been subjected to clearing, burning, ditching, farming, and other land-use practices during the past 250 years, has long experienced a dropping water table, and is now approximately 850 km^2 (85,000 ha) in extent (Carter 1979). In 1974 the Great Dismal Swamp National Wildlife Refuge (GDSNWR) was established. At the end of 1980 it was 41,026 ha in extent, 24 percent (9,866 ha) of it in North Carolina. Kirk (1979) provided an excellent summary of the history and lore of the Swamp.

Although there are conflicting historical reports about the abundance of wildlife in the Swamp (see Handley 1979), it is clear that the survival of some species there has been aided by remoteness and limited access to the public, as well as by the existence of large tracts of suitable habitat. For example, the only population of the black bear, *Ursus americanus americanus* Pallas, on the Virginia Coastal Plain, and perhaps the largest populations of the bobcat, *Lynx rufus floridanus* Rafinesque, are found in the Refuge and environs. However, its remoteness and relative inaccessibility have also apparently contributed to the dearth of studies of birds and mammals in the Swamp; apart from species lists, comparatively little is known about the wildlife.

The first systematic studies of mammals in the Swamp were conducted by the Bureau of Biological Surveys, U. S. Department of Agriculture, during the period 1895-1898. Handley (1979), in an exhaustive review that included an examination of field notebooks and unpub-

lished manuscripts, reported that collections of Dismal Swamp mammals were made during a total of 23 weeks in that period. A number of new species (now recognized as subspecies) were collected then, mostly near Lake Drummond. The greater short-tailed shrew, *Blarina brevicauda telmalestes* Merriam; southeastern shrew, *Sorex longirostris fisheri* Merriam; southern bog lemming, *Synaptomys cooperi helaletes* Merriam; and muskrat, *Ondatra zibethicus macrodon* (Merriam), were collected and named then. During the same period Rhoads and Young (1897) described the dark-colored meadow vole, *Microtus pennsylvanicus nigrans* Rhoads, from nearby northeastern North Carolina. In sum, the Dismal Swamp and nearby coastal marshes have several mammals that are morphologically distinguishable from other populations of these species, strongly suggesting genetic and perhaps geographic isolation of their populations in the past. One of Handley's (1980) concerns was that man-induced changes in the Swamp may have removed the ecological barriers between Swamp and upland subspecies. The likely result of such an event would be loss of the Dismal Swamp subspecies through genetic "swamping out" of the smaller gene pool. Of course, this is the equivalent of ecological extinction of the taxon.

C. S. Brimley (1897) was among the investigators who wrote about Dismal Swamp mammals, for he included the results of small mammal collections made between 1891-1894 by the Smithwick brothers near the head of Albemarle Sound in his history of the mammals of Bertie County, North Carolina. Brimley later (1905) summarized the findings of several investigators, including collections from the northeastern corner of North Carolina close to the Swamp. Both papers, while including some Dismal Swamp information, were based mostly on small mammals that Brimley and his brother collected near Raleigh, Wake County, from 1888 to 1900.

After a hiatus of about 25 years, sporadic collecting in the Swamp resumed in the 1930s. Handley's 1953 visits for a week each in February and June seem to have been typical of the trapping efforts made there. One of the longer mammal studies conducted in the Swamp was that of F. E. Breidling, Old Dominion University (ODU), who in 1979-1980 trapped four study areas for one week during each of three seasons.

Handley (1979) reported that the entire known Dismal Swamp fauna of mice and shrews consists of 12 species. Most investigators have found the white-footed mouse, *Peromyscus leucopus easti* Paradiso, to be the most common small mammal, and about half of them have also caught numerous golden mice, *Ochrotomys n. nuttalli* (Harlan), and short-tailed shrews, *Blarina brevicauda*. Five other species—the cotton mouse, *Peromyscus g. gossypinus* (Harlan); eastern harvest mouse, *Riethrodontomys h. humulis* (Audubon and Bachman); southern bog lemming; and southeastern shrew—were found to be numerous by only one or two collectors. Handley (1979) attributed this to spotty distributions

and local abundances. Finally, four species—the woodland vole, *Microtus pinetorum scalopsoides* (Audubon and Bachman); the house mouse, *Mus musculus domesticus* Rutty; the least shrew, *Cryptotis p. parva* (Say); and the meadow vole—were seldom caught by any collector, which may mean that the habitats required by these species are rarely found in the Swamp (Handley 1979).

On 23 February 1980, David Harrelson, a senior biology student at ODU, and I began a study of the small mammals of openings in the GDSNWR. The term "openings" refers to any area in which a significant level of shading provided by tree canopy is absent. These habitats are vegetated predominantly by cane, *Arundinaria gigantea*; softstem rush, *Juncus effusus*; sedges; grasses; and herbaceous forbs. Many openings also have small trees and shrubs, plus a number of woody vines; the most common of these are red maple, *Acer rubrum*; blackberry, *Rubus allegheniensis*; grape, *Vitis* spp.; and greenbriers, *Smilax* spp.

MATERIALS AND METHODS

Pitfall traps, made of No. 10 tin cans sunk into the ground flush with the soil surface and half-filled with water, were used to collect small mammals. Seven pitfall traps were dug and placed on 23 February, but adverse weather, including a record snowfall that covered the area for the first two weeks in March, delayed until 20 March the setting of twenty-eight additional traps. All 35 traps were set within 150 m of Jericho Ditch, north of Williamson Ditch, under the 110 kv electrical powerline in the northwestern corner of the GDSNWR.

On 10 April, 10 pitfall traps were placed 9 km away, under the same powerline near East Ditch, also in an area dominated by cane, grasses, and rushes. This area had a higher proportion of standing water than did the Jericho Ditch site. All traps were removed from the ground on 2 May 1980.

RESULTS

Only one small mammal, a *Microtus pennsylvanicus*, was captured in the seven traps from 23 February to 20 March. However, a total of 43 small mammals of seven species was trapped during the study period at the Jericho Ditch site (Table 1). At the East Ditch site, three small mammals of three species were caught (Table 1).

Based on the number of small mammals captured in 100 trap-nights, the relative density of small mammals appeared to be greater in the Jericho Ditch area (2.43) than in the East Ditch area (1.36). (One trap in place for one night equals one trap-night; relative density = N/trap nights X 100.) This difference in density may be due in part to the greater vegetational diversity of the Jericho Ditch site, and to the greater proportion of standing water on the East Ditch site.

Table 1. Number and species of small mammals trapped in the Dismal Swamp between 23 February and 2 May (Jericho Ditch area) and 10 April and 2 May (East Ditch area) 1980. "Others" refers to the results of previous investigations in the Dismal Swamp, mostly in the 1895-1906 period, but including Handley in 1953 (from Handley 1979, Table 1).

Species	Jericho Ditch	East Ditch	Others
	2/23 to 5/2	4/10 to 5/2	
Sorex longirostris	14	1	15
Blarina sp.	15		39
Cryptotis parva	2		1
Peromyscus leucopus	1		112
Ochrotomys nuttalli	1		50
Microtus pennsylvanicus	4	1	8
Synaptomys cooperi	6	1	21
	43	3	
Number mammals/100 trapnights	2.43	1.36	

DISCUSSION

Compared to previous investigators, we caught few individuals of the two most common species, *Peromyscus leucopus* and *Ochrotomys nuttalli*. This is not unexpected, because they are predominantly forest-dwellers and we restricted our trapping to openings dominated by herbaceous vegetation. However, the 40 m wide powerline right-of-way was bordered on both sides by maple-gum forest. Consequently, the proximity to nearby suitable habitat for these climbing species may explain their presence in the openings. Handley's 1953 study, which produced 34 *P. leucopus* and 14 *O. nuttalli* out of a total of 56 specimens, showed the typical numerical dominance of these two species. Breidling (1980) caught 15 *P. leucopus* and 4 *Ochrotomys* using live traps on four forested study plots.

We caught a relatively large number of meadow voles and southern bog lemmings (Table 1). Only 29 individuals of these two microtine species had previously been collected in the Swamp. Although he took one meadow vole in 1953, Handley (1979) contended that *Synaptomys* had not been collected there since November 1898. According to Handley (1979, 1980) several investigators, including himself, have speculated on

the likely extinction of the Dismal Swamp subspecies of the southern bog lemming, *Synaptomys cooperi helaletes*. We took specimens from both sides of Jericho Ditch, and one specimen near East Ditch. The cane-grass-sedge vegetation type is dominant under the powerline, and it is possible that *S. c. helaletes* occurs throughout this habitat. Starting in 1895, Fisher caught 21 specimens of southern bog lemming in the Swamp, mostly in cane patches near Lake Drummond. We took one *Synaptomys* in cane, but the remainder were captured in mixed grassland in which softstem rush was abundant. Meadow voles were present in the mixed grass habitat, but not in the cane.

By far our greatest success was in trapping shrews (Table 1). We captured 15 *Sorex longirostris fisheri*, which is as many as had been obtained by all previous investigators (Handley 1979). We caught 2 specimens of the least shrew, *Cryptotis parva*, compared to 1 taken by previous investigators, and 15 *Blarina*, compared to 39 collected in earlier studies. Our comparatively high success in capturing shrews is probably related to use of pitfall traps. An advantage of pitfall traps is that they more readily capture certain species of small mammals than do snap (or break-back) traps (Rose and McKean 1980). Rose (1980) reported the capture of 18 southeastern shrews in pitfall traps and none in snap traps. The conclusion that southeastern shrews are not effectively taken by snap (or live) traps is borne out by published records (reviewed by Rose 1980; French 1980).

Handley's (1979) fears that *S. longirostris fisheri* has been genetically "swamped out" through introgression with the smaller upland *S. l. longirostris* Bachman may be unfounded, at least for populations in the northwestern corner of the Swamp in 1980. With a mean total length of 95.8±2.3 mm, the 1980 Dismal Swamp southeastern shrews are much longer than any of the upland subspecies (French, pers. comm.). Whether these values are larger than the 1890s *S. l. fisheri* is uncertain, for Handley (1979:310, Table 1) did not give standard measurements for the 15 *S.l. fisheri* collected by Fisher and housed in the National Museum, nor have I examined the specimens. Nevertheless, the large size of the 1980 specimens suggests that *S. l. fisheri* has maintained genetic isolation from *S. l. longirostris*.

Similarly, the *Blarina* were large and undoubtedly referrable to *B. brevicauda telmalestes*, which Handley (1979) called the greater short-tailed shrew. Jones et al. (1979) referred to the taxon as *Blarina telmalestes*, the Dismal Swamp short-tailed shrew. This disparity of usage correctly indicates that the taxonomy of the genus *Blarina* is in flux. According to Tate et al. (1980) the Dismal Swamp is one region in which two distinctive sizes of *Blarina* occur, perhaps sympatrically; the larger is *B. brevicauda* and the smaller *B. carolinensis*.

The total number of species trapped in our study—seven—compares well with previous studies. Handley obtained the same

number in 1953, and of the four other studies he summarized (1979, Table 1), two obtained more species (8 and 9) and two obtained fewer species (4 and 6). Considering that this study was conducted at the end of winter, when mammal densities are usually at their lowest levels, it seems likely that other seasonal studies of the openings in the Dismal Swamp will provide additional useful information.

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